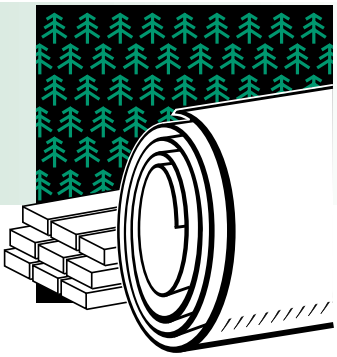
FOREST PRODUCTS

Project Fact Sheet



Use of Residual Solids from Pulp and Paper Mills for Enhancing Strength and Durability of Ready-Mixed Concrete

Benefits

- Saves pulp and paper industry $1 million in disposal costs for each 1% of residual solids used
- Increases life span of concrete structures by at least 50%
- Lowers government investments in concrete by about $10 billion/year
- Improves the Nation's infrastructure
- Saves about 36 trillion Btu of energy
- Avoids production of 7 million tons of CO_2 emissions
- Does not require a retrofit or replacement of a plant operation

Applications

During the final phase of this project, researchers will meet with industry partners to develop implementation plans for commercial introduction of the product in three to five years. Cellucrete will be used to expand the life of highways, roadways, and airport pavements, which are subjected to extreme weather conditions, frequent use, and the application of de-icing salts.

Technology Offers a Cost-Effective Solution for Disposing of Pulp Mill Waste and Reinforcing Ready-Mixed Concrete

U.S. pulp and paper mills generate more than 3.7 million tons of sludge each year for disposal. Although this sludge is known to contain useful fibers and chemicals, two-thirds of it is sent to landfills and incinerators. Researchers propose to incorporate the fibrous residuals from mills into ready-mixed concrete to improve the strength, durability, and life span of concrete structures exposed to weather. The life span of high-performance concrete (coined by researchers as "cellucrete") has the potential to rise from the normal 25 to 35 years to up to 100 years.

The new technology will offer the pulp and paper industry a practical and economical solution for waste disposal. It will also provide the concrete industry with a low-cost source of fibers to produce a better product for its customers. Government purchases of concrete could potentially decrease by one-third, equal to 20 million cubic yards of concrete annually. By avoiding that amount of concrete production, the industry's annual energy use and carbon dioxide emissions will be significantly reduced, which, along with keeping the mill sludge out of landfills, will be of significant benefit to the environment.

Residual Fibers Used in Concrete

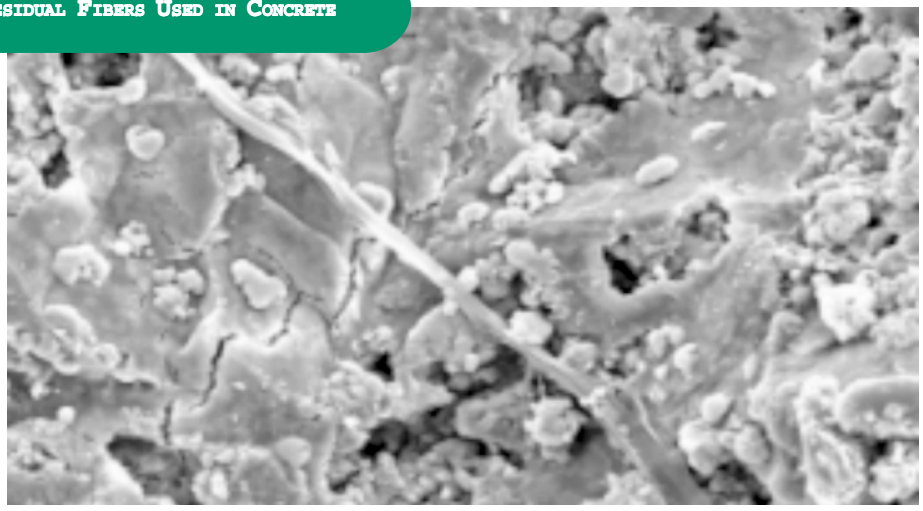


Figure 1. Residual fiber is shown reinforcing a micro-crack in concrete. (Photograph by the University of Wisconsin–Milwaukee Center for By-Products Utilization.)

Project Description

Goals: To establish technical, economical, and performance benefits for 100 percent recycling of pulp and paper mill residual solids in ready-mixed concrete and cast-concrete products.

Researchers will divide their tasks into three phases, each of one year duration. Phase I will include a background feasibility and literature search, laboratory tests to characterize the properties of residual solids from various mills, and work to establish mixture proportions for ready-mixed concrete. Phase II will begin with a study of market acceptance of the new concrete and continue with an economic impact study and specialized evaluations of the concrete. Phase III will include a field demonstration at a commercial plant using the mixtures that performed best in Phase I and II. It will conduct a construction demonstration and evaluation, a long-term evaluation of the mixtures in the laboratory, and technology transfer activities (including a workshop to exchange information on the new product with industry, government personnel, and other users of concrete). The final report will include testing specifications for residual solids use in concrete.

Progress & Milestones

- Previous research has shown that organic fibers can be used to manufacture cementitious concrete materials.
- Seven sources of residual solids from various types of pulp and paper mills were selected.
- Researchers completed characterization studies on the residual solids.
- Development and testing of the concrete mixture is ongoing; the appropriate mixture proportions for the ready-mixed concrete are based on mechanical properties such as compressive strength, splitting tensile strength, and flexural strength.

Project Partners

University of Wisconsin
Milwaukee, WI

Advanced Cast Stone Company
Random Lake, WI

Consolidated Papers
Wisconsin Rapids, WI

Fiber Clay Council
Darien, CT

Fox River Fiber Company
DePere, WI

Natl. Council of the Paper Industry
for Air and Stream Improvement
Kalamazoo, MI

New Berlin Redi-Mix, Inc.
New Berlin, WI

Weyerhaeuser Company
Tacoma, WA

Wisconsin Electric Power Company
Milwaukee, WI

Wisconsin Paper Council
Neehnah, WI

Wisconsin Public Service Corp.
Green Bay, WI

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